

Applicant's invention over the prior art as understood by the Applicant from the Examiner's grounds of rejection and supporting reasoning presented in the Final Office Action mailed on December 23, 2004.

Claims 1 and 9 recite a method of forming a bottle-shaped trench and a method of forming a bottle-shaped trench capacitor, respectively, the methods comprising the steps of "partially oxidizing the exposed doping region to form a doped oxide region thereon" and "removing the doped oxide region to form a bottle-shaped trench."

The Examiner relies upon the first method of Forster et al to teach all of the steps of claims 1 and 9 except the steps of partially oxidizing the exposed doping region to form a doped oxide region thereon and removing the doped oxide region to form a bottle-shaped trench.

The Examiner relies upon the third through fifth methods disclosed in Forster et al to teach that the lower trench is widened by means of a further etching step in order to enlarge the electrode surface, as illustrated in FIG. 5I of Forster et al.

The Examiner acknowledges that Forster et al do not teach the widening of the silicon trench by partially oxidizing the exposed doping region to form a doped oxide region thereon and removing the doped oxide region. Presumably, the Examiner relies upon Wolf et al to teach these limitations. In support of this position, the Examiner points out four teachings in Wolf et al, namely:

- 1) Wet etching silicon dioxide may be accomplished with hydrofluoric acid (page 532);
- 2) Thermal processing may include rapid thermal processing (pages 56-58);
- 3) The density of thermally grown fused silica is less than that of crystalline quartz (page 200); and
- 4) Diffusion in an oxidizing ambient can result in oxygen enhanced diffusion or oxidation retarded diffusion (page 264).

The teachings relied upon by the Examiner recite known characteristics of oxidation and silicon oxide. However, there is simply no teaching in the disclosures relied upon the Examiner of an

etching method comprising the steps of 1) oxidizing an exposed doping region to form a doped oxide region thereon; and then 2) removing the doped oxide region. Furthermore, the disclosures certainly fail to teach a process of widening a trench by the steps of partially oxidizing an exposed doping region to form a doped oxide region thereon and removing the doped oxide region to form a bottle-shaped trench, as recited in claims 1 and 9

Furthermore, the Examiner fails to establish motivation to combine the references. Forster et al simply teach that the trench is widened by a further etching step. An etching step does not equate with or suggest the steps of partially oxidizing the exposed doping region to form a doped oxide region thereon and removing the doped oxide region. Indeed, it is well known that a silicon trench can be directly etched by a suitable etchant such as KOH. What is the motivation, then, to widen the trench by partially oxidizing the exposed doping region to form a doped oxide region thereon and removing the doped oxide region? No teaching or suggestion that it would be desirable to do so can be found in Forster et al. Nor is there any teaching or suggestion in Wolf et al of the desirability of replacing an etching step with the steps partially oxidizing an exposed doping region to form a doped oxide region thereon and removing the doped oxide region. Indeed, the various facts about silicon oxide and oxidation disclosed in Wolf et al and relied upon by the Examiner are unrelated and therefore irrelevant to the Forster et al disclosure because the doped region in the trench is not oxidized in the method described by Forster et al. In sum, the only teaching of the desirability of the combination relied upon by the Examiner comes from the Applicant's own disclosure.

In the response to the Applicant's arguments, the Examiner states that there is motivation to combine the references by pointing firstly to Forster et al's teaching of widening the lower trench with an "etching step" and then to isolated teachings in Wolf et al. However, Forster et al do not teach or suggest the desirability of replacing the etching step with steps of partially oxidizing the exposed doping region to form a doped oxide region thereon and removing the doped oxide region. As for Wolf et al, the desirability of the combination simply cannot be found in the isolated disclosures that wet etching silicon dioxide may be accomplished with hydrofluoric acid, thermal processing may include rapid thermal processing, the density of thermally grown fused silica is less than that of crystalline quartz, and diffusion in an oxidizing ambient can result in oxygen enhanced diffusion or oxidation retarded diffusion.

The Examiner's statement that one of ordinary skill in the art would seek a way to further etch the lower trench region to enlarge the electrode surface as suggested by Forster et al without effecting or least effecting the surrounding substrate and Wolf et al provides a surface preparation so that silicon oxide may have a more open structure than crystalline silicon oxide and may be removed by HF is not pertinent for the same reasons. The mere fact that that silicon oxide may have a more open structure than crystalline silicon oxide and may be removed by HF would not lead one of ordinary skill to replace an etching step with steps of partially oxidizing the exposed doping region to form a doped oxide region thereon and removing the doped oxide region. Where is the Examiner looking to find this suggestion of the desirability of the combination other than Applicant's own disclosure? The Examiner is further reminded that the mere fact that references *can* be combined or modified does not render the resultant combination obvious unless the prior art also suggests the **desirability of the combination**. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

In addition, while Applicant acknowledges the Examiner's reliance on *In re McLaughlin*, in the absence of a teaching of the desirability of the combination in the prior art, it is evident that the Examiner is looking to Applicant's own disclosure as a template to piece together various teachings of the prior art, and is therefore impermissibly using knowledge gleaned from Applicant's disclosure in the rejections.

Finally, the Examiner argues that the Applicant has attacked references individually and, with reference to *In re Keller*, that "the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art." Nevertheless, the Examiner is reminded that, as clearly stated in MPEP 2142, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. **Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.** *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

As noted previously, there is simply no teaching or suggestion of the limitations "partially oxidizing the exposed doping region to form a doped oxide region thereon" and "removing the

doped oxide region to form a bottle-shaped trench" in either reference relied upon by the Examiner, irregardless of whether the references are taken alone or in combination. These limitations cannot simply be ignored.

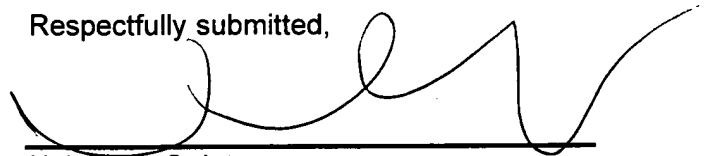
In conclusion, it is Applicant's belief that the Office Action fails to point out with particularity where Forster et al and/or Wolf et al, either alone or in combination, teach or suggest the limitations "partially oxidizing the exposed doping region to form a doped oxide region thereon" and "removing the doped oxide region to form a bottle-shaped trench," as recited in claims 1 and 9. In addition, it is Applicant's belief that the Office Action fails to establish where in the prior art the desirability of the combination of Forster et al and Wolf et al relied upon by the Examiner is taught. Therefore, Applicant submits that a *prima facie* case of obviousness of the claims cannot be established based on the references cited by the Examiner.

For at least these reasons, it is Applicant's belief that the rejections of claims 1 and 9 should be withdrawn and the claims passed to issue. Insofar as claims 2-8 and 10-20 depend from claims 1 and 9, it is Applicant's belief that these claims are also in condition for allowance.

Conclusion

For the reasons described above, the Applicant believes that the application is now in condition for allowance and respectfully requests so.

Respectfully submitted,



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